PATENT SPECIFICATION

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improvements in or relating to Amplitude Discriminator Circuit Arrangements

We, THE MARCONI COMPANY LIMITED of English Electric House, Strand, London, W.C.2, a British company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to amplitude discriminator circuit arrangements and has for its object to provide improved circuit arrangements which will produce from applied input signals comprising desired signals interspersed among undesired signals of smaller but comparable amplitude output signals in which the amplitude of desired signals in relation to that of undesired signals is substantially increased.

The primary, though not the exclusive application of the invention is to amplitude discrimination in video signals in radar receivers where it may be employed to produce a substantially increased effective signal to noise ratio. The invention offers the additional advantages, which are particularly advantageous when the said invention is employed for amplitude discrimination in video signals in radar receivers, that it transforms the normally different amplitude, more or less sinusoidal desired (echo) pulses commonly present in the input signals into relatively large, steep sided approximately flat topped pulses of substantially constant amplitude in the output signals. This, of course, is particularly desirable in cases in which the desired signals are required to be "processed" by arrangements involving decoders and/or coincidence gates.

According to this invention an amplitude discriminating circuit arrangement adapted to be fed with input signals including desired signals interspersed among undesired signals of smaller but comparable amplitude comprises a tunnel diode, a potentiometer having an adjustable slider, means for applying the input signal voltage across the resistance of said potentiometer, the slider of said potentiometer being connected to apply to said tunnel diode a proportion of the input signal voltage so selected that voltages due to undesired signals as applied to said diode are below the peak point voltage thereof, and means for taking output signals from across said diode.

The meaning of the term "peak point voltage" as herein employed will be clear from Fig. 1 of the drawing accompanying the provisional specification which is a representation of the characteristic connecting current (I) with voltage (V) of a typical tunnel diode.

Referring to Fig. 1 it will be seen therefrom that if the voltage applied to a tunnel diode is increased, the current therethrough increases approximately linearly until a peak (corresponding to a voltage V_p the value of which depends on the particular diode chosen) is reached after which further increase of applied voltage results in a rapid decrease of current which falls away to a relatively low value which is maintained very roughly constant over an appreciable further rise of applied voltage before, with still further increase of applied voltage, the current again rises rapidly.

Preferably the input voltage is applied across the resistance of said potentiometer through a transformer.

A preferred embodiment of the invention comprises a transformer, means for applying input signals to the primary thereof, a potentiometer the resistance of which is connected across the transformer secondary, a tunnel diode connected on one side to

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the slider of the potentiometer through a further resistance and on the other side to one end of the potentiometer resistance and means for taking output signals from across the tunnel diode.

Preferably output signals are taken from the tunnel diode through a non-phase-inverting amplifier which may be followed, if desired, by an emitter follower transistor stage.

The invention is illustrated in Fig. 2 of the drawings accompanying the provisional specification and its operation will be further explained in connecton with Fig. 1 (already described) and the additional graphical figures 3 and 4 of the said provisional specification.

Referring to Fig. 2 Radar receiver video signals are applied to the primary 1 of a one-to-one transformer the secondary 2 of which is shunted by a potentiometer resistance 3 having a slider 4 movable over at least a portion thereof. The input signals comprise desired echo signals, standing up by varying amounts from undesired signals constituted by noise and the like. The slider 4 is connected through a resistance 5 to one side of a tunnel diode 6 the other side of which is connected to the earthed end of secondary 2. The diode may be, for example, of the type known under the trade designation IN2939. Output is taken from the diode through a non-phase-inverting amplifier 7, preferably of adjustable gain and which, in a normal case, might have a gain of say, 10, to the output terminal 8. If desired the next video stage (not shown) may be fed from terminal 8 through an emitter follower transistor (also not shown).

As will be seen the transformer isolates any standing D.C. there may be on the line (not shown) through which the input signals are applied to primary 1 and also provides a low resistance D.C. path for the diode 6. In a normal case the Radar video signals will comprise between 0.5 to 1.0 volts "shoulder noise" plus from 5 to 10 volts of desired signals and a positive going wave form as typified by Fig. 2 (in which desired signals are referenced D) will appear across the secondary 2. The slider 4 is so adjusted that the maximum voltage across the diode due to unwanted signals is below the peak point voltage V_p (see Fig. 1) of the diode. In a typical practical case V_p might be 50 mV.

Signal voltages applied to the diode and exceeding V_p cause the voltage across the diode to change rapidly from a value determined by V_p to a new value V_{fp} (again see Fig. 1) which is the forward voltage across the diode and in a typical case might be 500 mV. All signals are now, accordingly, limited by the action of the series resistance 5 and the diode 6 acting as an ordinary conventional diode, to V_{fp}. The signals obtained from across the diode will accordingly be as typified in Fig. 4. Comparing Figs. 3 and 4 it will be seen that the desired signal/noise ratio is much improved and that the desired signals are of good approximately rectangular shape and substantially constant amplitude.

With the figures above given the ratio of unwanted signal to wanted signal in Fig. 4 would be 50 to 500.

With a suitable diode such as the IN2939 diode already mentioned, the transition from (say) 50 mV to 500 mV through the negative resistance region of the characteristic (see Fig. 1) is limited only by circuit capacity and the speed of the diode and, with good design, can readily be made to occur in less than 50 nanoseconds. Accordingly the desired signals in the output can be both steep-sided and flat topped.

Tunnel diode characteristics are very stable and over temperature ranges of about −30°C to about +70°C temperature effects can in practice be ignored. If, however, full advantage of the invention is to be taken in a Radar receiver, the receiver gain should be stabilised.

WHAT WE CLAIM IS:—

1. An amplitude discriminating circuit arrangement adapted to be fed with input signals including desired signals interspersed among undesired signals of smaller but comparable amplitude said arrangement comprising a tunnel diode, a potentiometer having an adjustable slider, means for applying the input signal voltage across the resistance of said potentiometer, the slider of said potentiometer being connected to apply to said tunnel diode a proportion of the input signal voltage so selected that voltages due to undesired signals as applied to said diode are below the peak point voltage thereof, and means for taking output signals from across said diode.

2. An arrangement as claimed in claim 1 wherein the input voltage is applied across the resistance of said potentiometer through a transformer.

3. An arrangement as claimed in claim 1 or 2 and comprising a transformer, means for applying input signals to the primary thereof, a potentiometer the resistance of which is connected across the transformer secondary, a tunnel diode connected on one side to the slider of the potentiometer through a further resistance and on the other side to one end of the potentiometer resistance and means for taking output signals from across the tunnel diode.

4. An arrangement as claimed in any of claims 1 to 3 wherein output signals are

taken from the tunnel diode through a non-phase-inverting amplifier.

5. An arrangement as claimed in claim 4 wherein the non-phase-inverting amplifier is followed by an emitter follower transistor stage.

6. Amplitude discriminating circuit arrangements substantially as illustrated in Fig. 2 of the drawings accompanying the provisional specification and herein described with reference to Figs. 1, 3 and 4 of the drawings accompanying the said provisional specification.

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PROVISIONAL SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

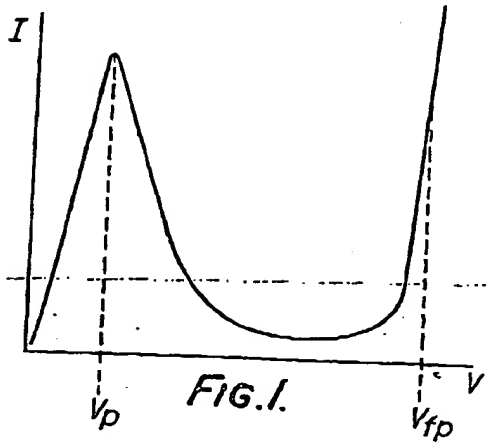

FIG. 1.

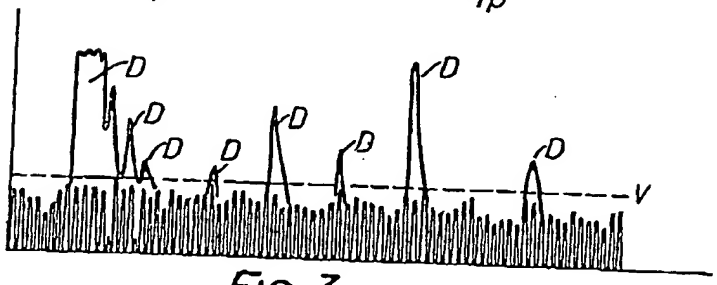

FIG. 3.

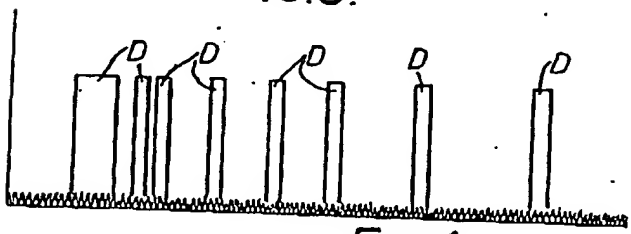

FIG. 4.

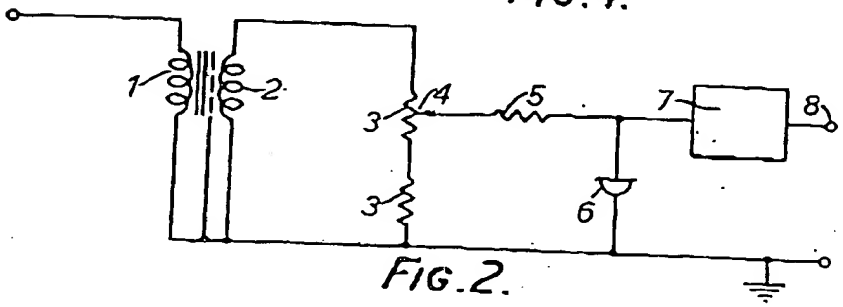

FIG. 2.